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(54) **Tubular heat exchangers**

(57) A header tank for a heat exchanger eg a vehicle radiator, comprises an extruded metal or plastics hollow or re-entrant elongate section (11) with intergrally extruded longitudinally extending projections (13, 14, 17, 18) which can be used for mounting and/or connecting purposes.

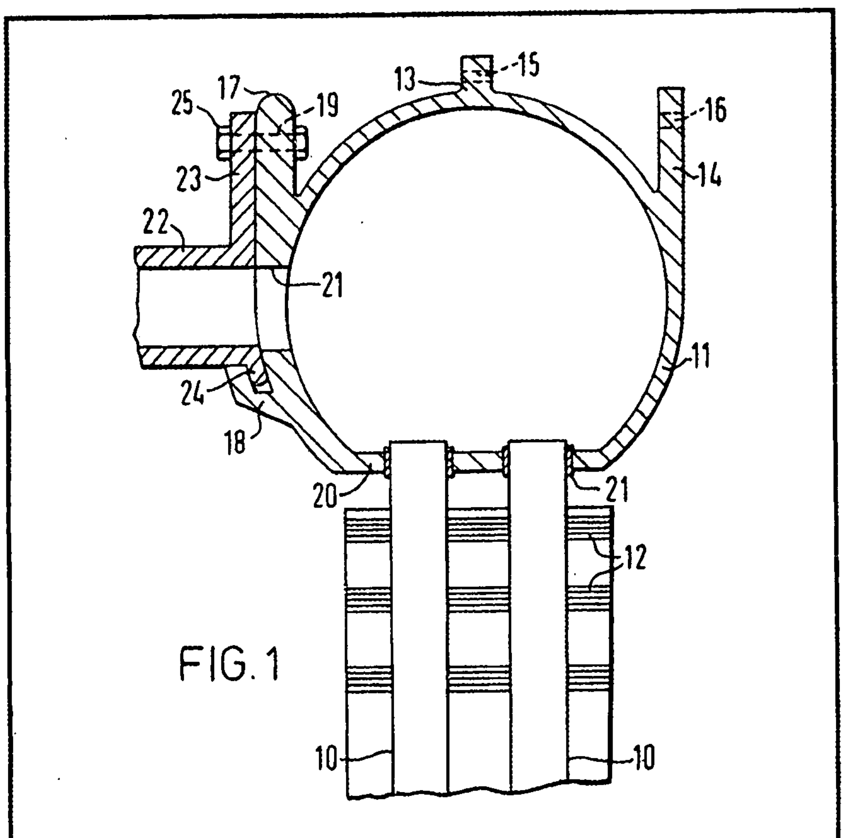

FIG.1

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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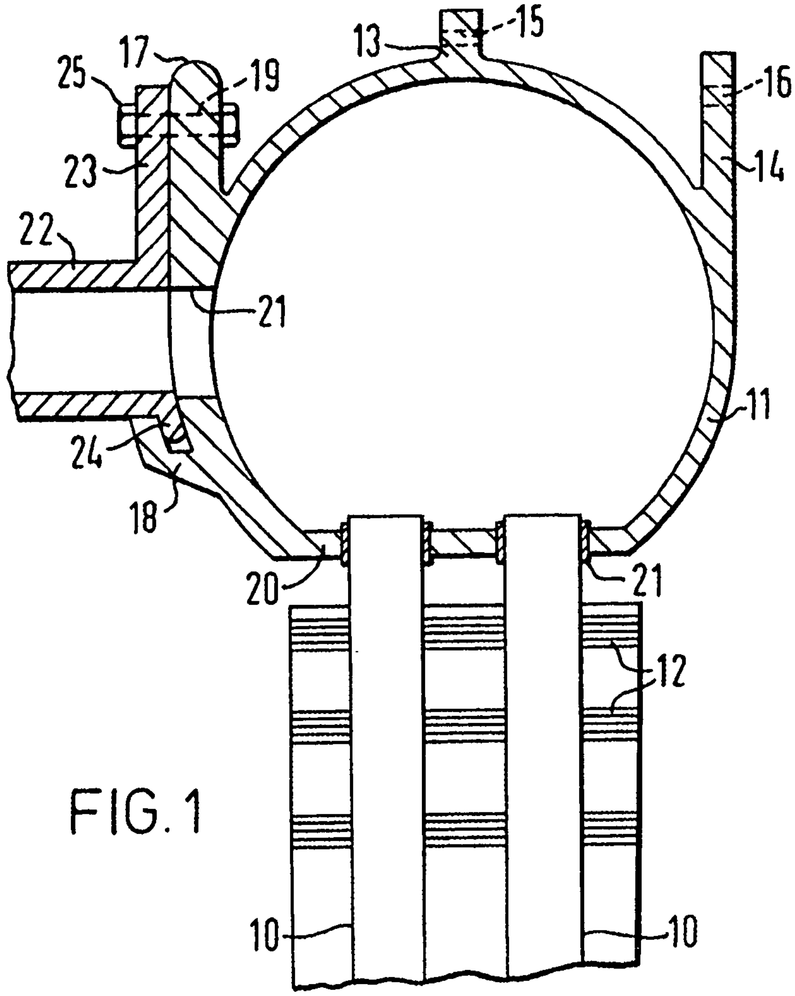


FIG. 1

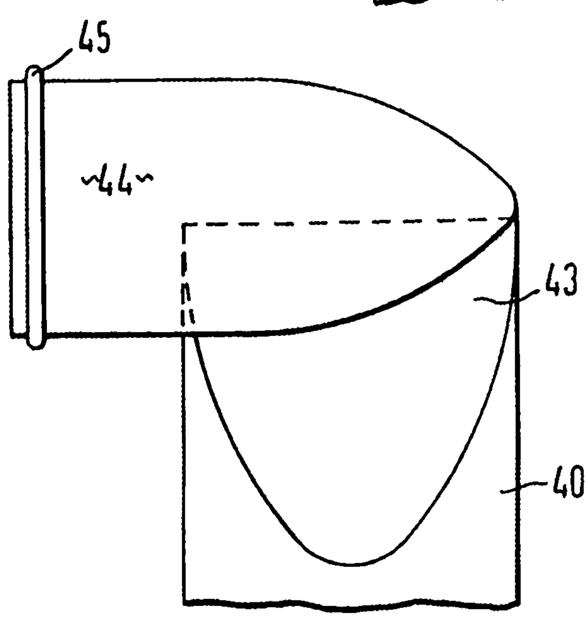


FIG. 4

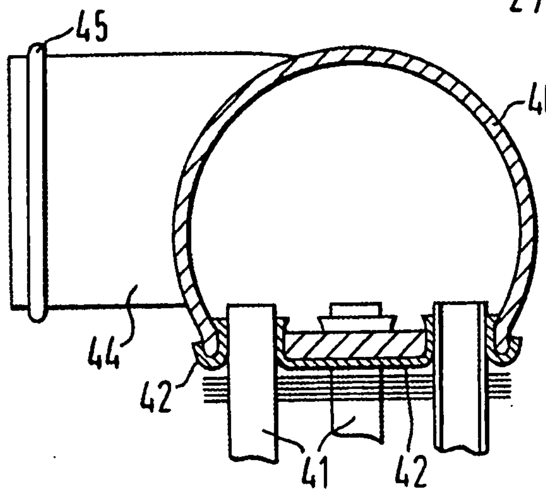


FIG. 2

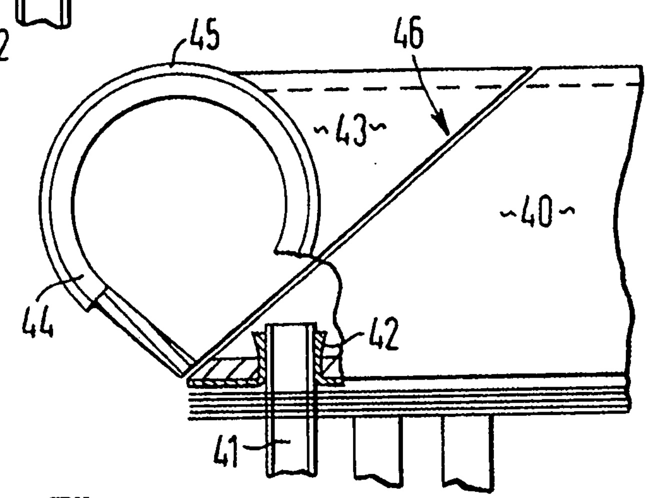


FIG. 3

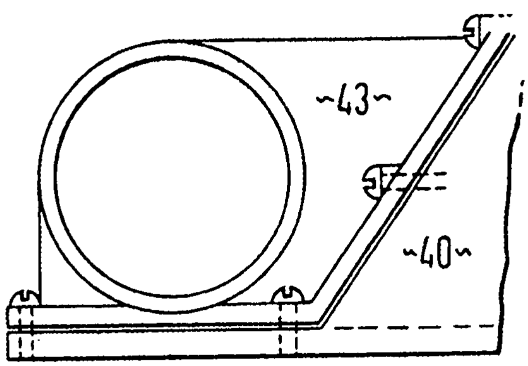
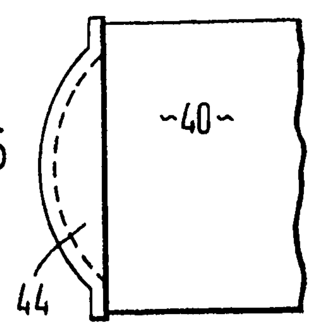
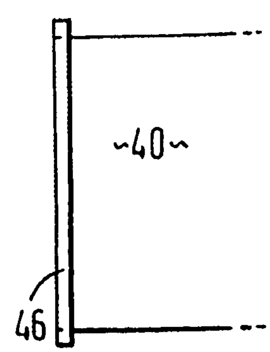


FIG. 5

FIG. 7

FIG. 6





SPECIFICATION

Improvements in heat exchangers

This invention relates to improvements in heat exchangers, particularly heat exchangers or radiators which are employed for cooling the water or oil which circulates around certain types of internal combustion engines. It is also applicable to air to air heat exchangers.

Heat exchangers used for cooling the water of internal combustion engines normally comprise a bank or banks of finned tubes which extend between header tanks. Air is circulated around the tubes to cool the water as it passes from one header tank to another. The tubes and fins together with the header tanks have traditionally been made of metal, but header tanks made partly or wholly of plastics material have recently been introduced. The tubes and fins remain made of metal, however, because of the heat exchange requirements in the radiator. Prior proposals for header tanks of plastics material have involved the use of mouldings to make the header tank or component parts thereof. Manufacturing mouldings is relatively expensive, and also involves the loss of material in the flashings which need to be removed to finish the product correctly.

It is an object of the present invention to provide an improved header tank for a heat exchanger which is cheaper and easier to make than the moulded tanks.

According to one aspect of the present invention a longitudinally extending header tank for a heat exchanger comprises an extruded metal or plastics hollow or re-entrant section having an integrally extruded longitudinally extending portion or portions adapted to provide mounting and/or connecting means.

Said mounting and/or connecting means may include two or more projections extending longitudinally along the tank. Two or more of said projections may be adapted to cooperably provide mounting and/or connecting means.

At least one projection may be angled or crooked so as to form a recess adjacent the tank section suitable for the location of an inlet or an outlet member relative to the tank. Said inlet or outlet member may be bolted, solvent welded, ultrasonically welded or electron beam welded to the connecting means.

Orifices may be provided in the projections so as to facilitate mounting or connection thereto. When the section is hollow, orifices are also provided in a flat face of the section to enable heat exchange tubes to enter the header tank. Typically, such tubes will be of the quasi-rectangular variety i.e. they will in cross-section appear as a rectangle with rounded corners and slightly convex longer sides. Alternately, round tubes may be used.

According to another aspect of the invention a longitudinally extending header tank for a heat exchanger comprises an extruded metal or plastics hollow or re-entrant section of constant cross-sectional shape having at at least one of its ends an end portion which is sealedly connected to the section, said end portion being adapted to provide connecting means for connecting an inlet or an outlet to the header tank.

The end portion may also be adapted to provide mounting means for the header tank. It may also incorporate a vent pipe and/or a thermostatic switch and/or provision for filling the draincock. The end portion may be made of metal or plastics material.

Where the section is hollow it may have a flat face which is pierced to provide orifices into which heat exchange tube ends can be inserted. The holes may be formed by punching or machining to remove the material, or friction or hot-tool formed either before or after the extrusion is cut to the appropriate length. The end of the section which is sealedly attached to the end portion may be at an inclined angle relative to said flat surface in a direction longitudinally of the header tank.

When assembled in the heat exchanger, the seal between the tubes and the orifices in the flat face of the header tank is preferably made by an elastomer gasket. This gasket may be a single piece gasket adapted to provide sealing for all the tube ends in the heat exchanger.

According to a further aspect of the invention, a method of manufacturing a header tank for a heat exchanger comprises continuously extruding a metal or plastics substance through a die to form a product having a hollow or re-entrant cross-section, dividing the extruded product into lengths suitable for a header tank, and capping the open ends of the extruded product produced by the division, said product having integrally extruded continuous projections adapted to provide mounting and/or connecting means for the header tank.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a side elevation in section of part of a heat exchanger incorporating a first header tank according to the invention,

Figure 2 is a side elevation in section of part of a heat exchanger incorporating a second header tank according to the invention,

Figure 3 is an end elevation of the heat exchanger of Fig. 2,

Figure 4 is a plan elevation of the heat exchanger of Fig. 2, and

Figures 5, 6 and 7 are side elevations of parts of alternative header tanks according to the invention.

The heat exchanger or radiator of Fig. 1 has parallel metal tubes 10 of quasi-rectangular cross-section extending between an upper

header tank 11 and a lower header tank (not shown). The tubes 10 are arranged in two banks and have metal finning 12 brazed to them extending between the tanks to enhance the heat exchange characteristics of the radiator. In Fig. 1 the longer sides of the rectangular tube cross-section are seen.

The header tank 11 is made from plastics material which has been extruded through a die, cut to the length of the tank 11, and provided with plastics end caps (not shown) which have been solvent or electron beam welded into place. When viewed in cross-section, the tank 11 is generally cylindrical with a lower flat face which provides a header plate 20 for tubes 10. The extrusion includes two mounting projections 13 and 14 which in use extend upwardly from the upper side of the tank 11. Mounting projection 13 is approximately centrally located in the upper surface of tank 11, whilst mounting projection 14 is at the edge of the tank 11. Either or both of these two mounting projections 13, 14 have holes 15, 16 drilled through them at suitable positions to enable the tank 11 to be bolted or similarly secured to the engine compartment of a motor vehicle. Although two mounting projections are shown, there may be only one mounting projection required, or indeed none at all, which simplifies the extrusion.

An upper and a lower connector projection, 17 and 18 respectively, are also provided on the extruded tank. The upper connector projection 17 extends upwardly from the tank 11 on the side of the tank 11 away from the mounting projection 14, and has a plane face on its side looking away from the tank 11. Bolt holes 19 are provided at suitable intervals along the upper connector projection 17.

The lower connector projection 18 extends outwardly from tank 11 and is angled upwardly towards the upper connector projection 17 to provide an upwardly opening recess adjacent the surface of the tank 11.

Before or during assembly of the header tank 11 to the bank of tubes 10, holes are made in the header plate 20 in accordance with the number and spacing of tubes 10. The ends of tubes 10 are then positioned in the header plate 20 and sealed therein by means of elastomeric gromments 21 or alternatively an elastomeric gasket which extends around all the ends of tubes 10 in the heat exchanger.

Holes 19 and 15 and/or 16 are made in their respective projections either before or during the assembly of the heat exchanger into its location eg in an engine compartment. One or more inlet or outlet holes 21 are also made in the side of the tank 11 between connector projections 17 and 18. The inlet or outlet holes 21 will normally be circular and of a similar cross-section to those provided in an inlet or outlet pipe 22 to be connected to the entry or exit.

The pipe (or pipes) 22 has at its header tank end an upwardly projecting flange 23 with a plane face which fits against the plane face of the upper connector projection 17. Flange 23 is held to the upper connector projection 17 by a bolt 25 passed through a hole in flange 23 and bolt hole 19 in projection 17.

The pipe (or pipes) 22 also has a downwardly projecting flange 24 which fits into the recess between the lower connector projection 18 and the tank 11. This interlocking provides means for initially locating the end of pipe 22 relative to the tank 11. A sealing gasket may be placed between the flanges 23, 24 and the plane face of projection 17.

The inlet/outlet connections to the tank 11 could be provided on the same side as the mounting projection 14. Alternatively, the mounting projection could be identical with one of the connector projections ie said projection could fulfil both mounting and connector functions.

In the example illustrated in Figs. 2, 3 and 4 a plastics header tank 40 is extruded having a D-shaped cross-section and cut to an appropriate length. The flat face of the D is pierced to provide orifices for heat exchange tubes 41, the tube end/header tank seals being provided by an elastomeric gasket 42. At one end (not shown) the header tank 40 is capped and at its other end is cut at an inclined angle to the flat face of the D in a direction along the length of the tank 40 to provide annular end face 46. An end portion 43, also of plastics material, is sealedly connected (eg by electronic welding or solvent welding) to end face 46.

End portion 43 incorporates an inlet/outlet 44 of circular cross-section extending at right-angles to the direction along the length of the header tank 40. The free end of the inlet/outlet 44 has annular beading 45 over which a hose may be passed, said hose (not shown) being suitably held to the inlet/outlet 44 by a screw clip. The end portion 43 has a moulded bracket 47 on its underside which enables the end portion 43 and its associated header tank 40 to be mounted in an engine compartment by means of a suitable fastening. A vent pip or draincock or thermostatic switch (not shown) may be incorporated in or from part of the end portion.

The examples of Figs. 5, 6 and 7 show variations in the end portion which may be employed. In Fig. 5 the end portion 43 is bolted onto the extruded header tank 40. The wall thickness of the extrusion at the bolting positions may be thicker than the remaining wall thickness, to provide suitable bolting positions. In Figs. 6 and 7, different end caps, 44 and 45 respectively are shown, and they have been hotplate welded or friction welded to the tank 40. It will be appreciated that a

known suitable joining process may be employed to sealedly connect the end portions or caps to the tank. Metal end portions could be crimped on if suitable projections were formed on the ends of the tank.

CLAIMS

1. A longitudinally extending header tank for a heat exchanger, comprising an extruded metal or plastics hollow or re-entrant section having an integrally extruded longitudinally extending portion or portions adapted to provide mounting and/or connecting means.

2. A header tank as claimed in Claim 1 in which said mounting and/or connecting means may include two or more projections extending longitudinally along the tank.

3. A header tank as claimed in Claim 2 in which two or more of said projections are adapted to co-operably provide mounting and/or connecting means.

4. A header tank as claimed in Claim 2 or Claim 3 in which at least one projection is angled or crooked so as to form a recess adjacent the tank section suitable for the location of an inlet or an outlet member relative to the tank.

5. A header tank as claimed in Claim 4 in which said inlet or outlet member is bolted, solvent welded, ultrasonically welded or electron beam welded to the connecting means.

6. A header tank as claimed in any one of Claims 2 to 5 in which orifices are provided in the projections so as to facilitate mounting or connection thereto.

7. A header tank as claimed in Claim 6 in which the extruded section is hollow, and orifices are provided in a flat face of the section to enable heat exchange tubes to enter the header tank.

8. A longitudinally extending header tank for a heat exchanger comprising an extruded metal or plastics hollow or re-entrant section of constant cross-sectional shape having at at least one of its ends an end portion which is sealedly connected to the section said end portion being adapted to provide connecting means for connecting an inlet or an outlet to the header tank.

9. A header tank as claimed in Claim 8 in which the end portion is also adapted to provide mounting means for the header tank.

10. A header tank as claimed in Claim 9 in which the end portion incorporates a vent pipe and/or a thermostatic switch and/or provision for filling the draincock.

11. A header tank as claimed in Claim 8 in which the extruded section is hollow and has a flat face which is pierced to provide orifices into which heat exchange tube ends can be inserted, the end of the section which is sealedly attached to the end portion being at an inclined angle relative to said flat surface in a direction longitudinally of the heat exchanger.

12. A method of manufacturing a header tank for a heat exchanger comprising continuously extruding a metal or plastics substance through a die to form a product having a hollow or re-entrant cross-section dividing the extruded product into lengths suitable for a header tank, and capping the open ends of the extruded product produced by the division, said product having integrally extruded continuous projections adapted to provide mounting and/or connecting means for the header tank.

13. A method as claimed in Claim 12 in which the extruded section is hollow and has a flat face which is pierced to provide orifices into which heat exchange tube ends can be inserted, said orifices being made in the flat face prior to the extrusion being divided into header tank lengths.

14. A header tank for a heat exchanger according to Claim 1 substantially as hereinbefore described with reference to as as shown in the accompanying drawings.

15. A method of manufacturing a header tank according to Claim 12 and substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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